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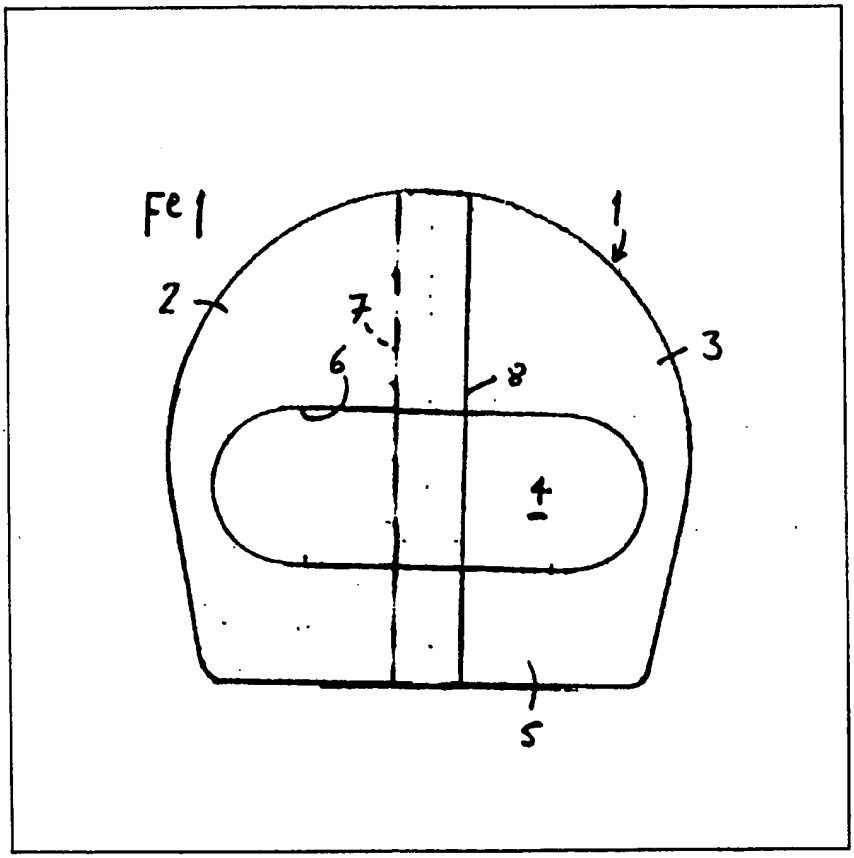
(54) Manufacture of hollow plastics articles

(57) Articles such as motor cyclists safety helmets are manufactured by press or injection moulding non re-entrant parts (2, 3;) and assembling the parts into completed articles by securement at lap or other inter-fitting joint formations formed on the parts. The parts can be of glass fibre reinforced synthetic resin and secured by adhesive but thermoplastic parts can be welded together. Helmet parts can comprise two parts joining on a vertical median plane; the parts may be differently coloured to provide a multi-coloured decorative effect.



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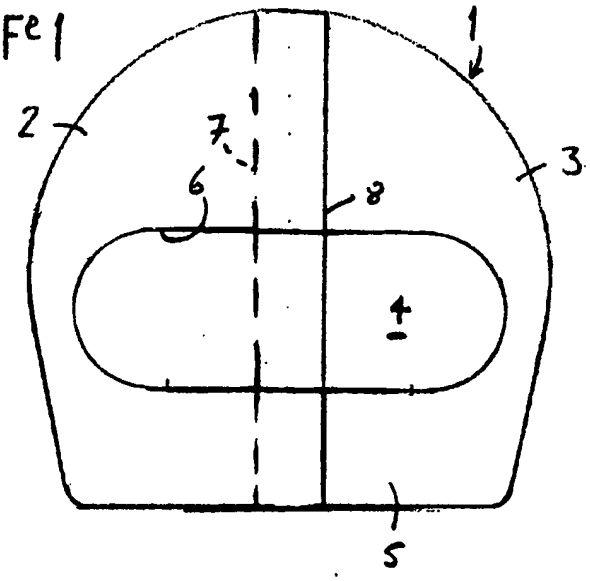

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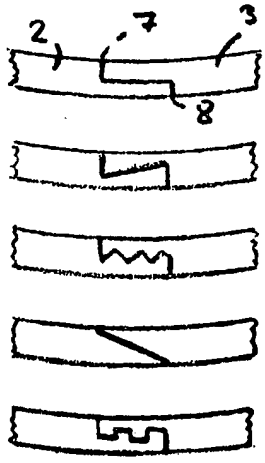

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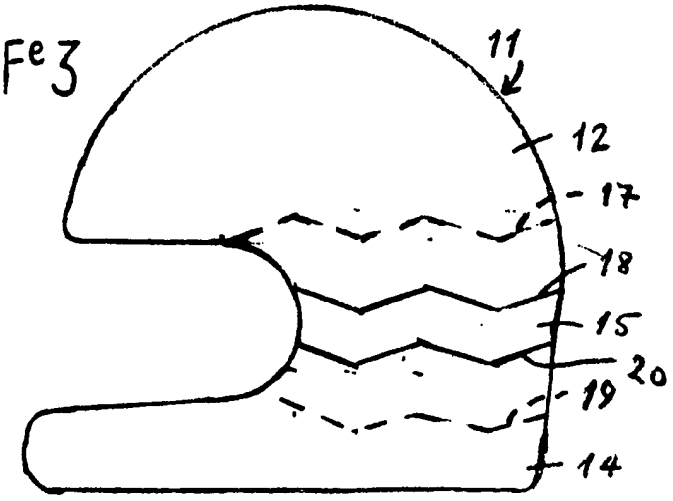

SPECIFICATION

Manufacture of hollow plastics articles

The invention relates to the manufacture of hollow articles of reinforced plastics material, for example, glass fibre reinforced synthetic resins. The invention is applicable particularly but not exclusively to the manufacture of safety helmets as used for example by motor cyclists.

It is conventional to manufacture a glass fibre laminate motor cycle safety helmet in one piece by hand laminating the material within an open mould. This requires a considerable amount of hand labour. The neck aperture of the helmet is located at the aperture of the open mould, but the neck aperture is not at the smallest cross-section of the helmet, that is, the helmet is of re-entrant form, so the mould must be a split mould, the parts of which are separated after the setting of the resin, to permit removal of the unfinished helmet. The product removed from the mould still requires further manual operations to be performed on it, to cut out the face aperture of the helmet and to trim the bottom edge of the helmet, around the neck aperture. Moreover, the surface obtained is not invariably satisfactory and hand filling may be needed to produce a finish of the required quality. This manufacturing method is therefor wasteful both of time and material.

The present invention is accordingly concerned with the provision of an improved method of manufacturing hollow articles of reinforced plastics material, in particular safety helmets, and with the products of such improved method.

The invention accordingly provides a method of making a hollow article of reinforced plastics material, the method comprising the steps of separately moulding at least two parts and securing the two parts together to form the article.

The parts may be conveniently press or injection moulded and secured together by an adhesive layer or by welding where the plastics material is thermoplastic. Preferably securement is effected along substantially the entire length of the adjoining edges. Preferably also the adjoining edges have interfitting formations to provide a greater area for securement than would be afforded by a butt joint, to ensure a strong connection. Although live welding could be employed, securement either by adhesive or by welding is preferably effected over substantially all the area over which the parts engage.

The invention also provides a method of making a shell of re-entrant form for a motor cyclist safety helmet, the method comprising the steps of moulding a plurality of parts each of non re-entrant form and securing the parts together at adjoining edges of the parts.

The adjoining edge position can be selected from a range of possible positions for example the adjoining edges can contain the vertical median plane of the shell or at least one plane extending horizontally through the shell. To ensure good adhesive contact the adjoining edges can be shaped to form a lap joint, a tapered lap joint or a dog tooth, scarf or castellated joint, and at least one of the internal and external lines on which the adjoining edges abut can extend in three dimensions. For decorative purposes the parts can be differently coloured.

For a more complete understanding of the invention, reference may be made to the following illustrative description and the accompanying drawing, in which:

Figure 1 is a schematic front view of a first helmet embodying the invention;

Figs. 2A, 2B, 2C, 2D and 2E are schematic fragmentary sectional views through the wall of a helmet such as that of Figure 1, each showing a different kind of joint that can be used between parts of the helment; and

Figure 3 is a schematic side view of a second helment embodying the invention.

A safety helmet 1 shown in Figure 1 of the drawing is manufactured in accordance with the invention in two parts 2, 3 which are then assembled together to make up a complete helmet shell to which are subsequently added such complementary parts as a visor, etc. The helmet 1 has a conventional generally dome-like shape with a rear wall portion 4 continued forwardly to form a top portion and side wall portions joined by a chin guard portion 5 beneath an eye aperture 6. The division between the two parts is at least approximately along the vertical median plane, so that each of the parts 2, 3 can be press-moulded in a simple two-part mould.

The manufacture of each of the two parts 2, 3 thus comprises the steps of positioning appropriate amounts of glass fibre mat and resin within the mould cavity of a two-part press mould. Conveniently glass fibre mats pre-impregnated with the resin are employed; in either event, the amounts required for each moulding operation can be accurately estimated, so wastage is substantially eliminated. The mould is then closed and opened again after an appropriate setting time to allow removal of the moulded helmet part.

The two helmet parts 2, 3 thus prepared are then bonded together by a suitable adhesive for example a thermo-setting epoxy adhesive. To provide greater bonding strength than would be afforded by butt-jointing the two parts, they are preferably shaped at the adjoining edges so as to provide substantial overlapping surface areas over which the adhesive bonding can take effect. The adjoining edges of the parts 2, 3 thus abut internally and externally on respective lines 7, 8 which are laterally spaced. Between the joining lines 7, 8 the edges can be shaped to provide a lap joint as shown in Figure 2A, but there could be employed instead a tapered lap joint, a dog tooth, scarf or castellated joint as shown respectively in Figs. 2B, 2C, 2D and 2E. If preferred, extra thickness for the helmet wall could be introduced for reinforcement at the join.

Figure 3 shows a helmet 11 having the same general configuration as that of Figure 1 but formed of three separately moulded parts, an upper part 12, a lower part 14 providing a chin

guard, and an intermediate part 15, so that the adjoining edges of these parts include horizontal planes. The edges are again shaped to provide substantial areas of overlap. Moreover, the spaced lines on which the edges abut are non-planaer; as shown, the internal and external lines 17, 18 at which the parts 12 and 15 abut and also the lines 19, 20 at which the parts 15 and 14 abut are of zig-zag configuration. Such lines can of course be extended from lines lying wholly in one plane in other ways; for example the lines could be undulating lines.

Although the invention has been illustrated and described with reference to a simple form of full face safety helmet, it will be evident that it can be applied not only to helmets of different shapes, for example, open face helmets without the chin guard, but to other hollow articles, all of which may divide into two or more parts in any convenient way. The separately moulded parts of a helmet or other article manufactured in accordance with the invention can readily be made in different colours so the invention makes it possible to produce decoratively multi-coloured articles. Thus, for example, the helmet 11 of Figure 3 can have the upper part 12 of one colour and lower parts 14, 15 of a different contrasting colour, of the intermediate part 15 can constitute a contrasting stripe between like-coloured parts 12, 14. This effect is enhanced by the zig-zag form of the lines 18, 20. The position and shape of the join or joins can thus be selected with visual consideration in mind as well as the strength of the article.

The advantages of the present invention are to be seen in the savings in time and material it permits in comparison with conventional procedures. Only moulds of relatively simple non-re-entrant shape need be employed for press or injection moulding of the parts and moulded and assembled parts produced in accordance with the invention need little finishing. Moreover, storage requirements can be reduced, as the parts can be stacked one in another before assembly in a way that is not usually possible at any stage of manufacture of a one piece helment or other hollow article.

CLAIMS

1. A method of making a hollow article of reinforced plastics material, the method comprising the steps of separately moulding at least two parts and securing the two parts together to form the article.

2. A method as claimed in claim 1 in which the article is a safety helmet.

3. A method of making a shell of re-entrant form for a motor cyclist safety helmet, the method comprising the steps of moulding a plurality of parts each of non re-entrant form and securing the parts together at adjoining edges of the parts.

4. A method as claimed in claim 2 or 3 in which the adjoining edges contain the vertical median plane of the shell.

5. A method as claimed in claim 2 or 3 in which the adjoining edges contain at least one plane extending horizontally through the shell.

6. A method as claimed in any preceding claim in which the adjoining edges of the parts have interfitting formations to provide a greater area for the adhesive layer than would be afforded by a butt joint.

7. A method as claimed in claim 6 in which the adjoining edges of the parts are shaped to form a lap joint, a tapered lap joint or a dog tooth, scarf or castellated joint.

8. A method as claimed in any preceding claim in which at least one of the internal and external lines on which the adjoining edges abut extends in three dimensions.

10. A method as claimed in any preceding claim in which the parts are press moulded.

11. A method as claimed in any preceding claim in which the parts are injection moulded.

12. A method as claimed in any preceding claim in which the parts are secured by an adhesive layer.

13. A method as claimed in any preceding claim in which the parts are of glass fibre reinforced synthetic resin.

14. A method as claimed in any one of claims 1 to 12 in which the parts are of thermoplastic material and are secured by welding.

15. A method as claimed in any preceding claim in which the parts are secured together over substantially the entire area of abutment of the parts.

16. A method as claimed in any preceding claim in which the parts are secured together over substantially the entire area of abutment of the parts.

17. A method of making a safety helmet substantially as herein described with reference to Figure 1 or Figure 3 of the accompanying drawing.

18. A hollow article made by the method of any preceding claim.

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